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Formulation and Preparation of Spicy Peanut Chikki

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Abstract: ***Enhancing Traditional Confections: Development and Characterization of Spicy Peanut Chikki. Spicy Peanut Chikki is a novel adaptation of the traditional Indian brittle, incorporating a blend of spices to elevate its sensory appeal and nutritional profile. This research investigates the formulation, production, and physicochemical properties of Spicy Peanut Chikki, focusing on the effects of adding chili powder, cumin powder, ginger powder, chat masala and other spices to the classic peanut and jaggery base. The study evaluates the product's texture, flavor profile, shelf life, and consumer acceptability using sensory and instrumental analysis. Results indicate that the incorporation of spices enhances the flavor complexity without compromising the structural integrity of the chikki. This innovation preserves the cultural essence of traditional chikki while appealing to modern palates, offering potential for commercial production and increased market demand. This research meticulously investigates the formulation of a novel spicy peanut chikki, expanding upon the traditional Indian confection by incorporating a carefully selected blend of spices. The study systematically outlines the preparation process, commencing with the precise development of a jaggery-based syrup cooked to a critical hard-ball/crack stage, ensuring optimal textural attributes in the final product. Subsequently, high-quality roasted peanuts are uniformly integrated into the molten syrup, followed by the incorporation of a custom-designed spice mixture. This spice blend, featuring red chili powder for heat, cumin and coriander powders for earthy and citrusy undertones, black salt for a distinctive savory note, and a subtle hint of asafoetida for aromatic complexity, aims to create a unique and appealing flavor profile.***

Keywords: Spicy Peanut Chikki, Product Analysis, Sensory Evaluation.

I. INTRODUCTION

India, with its diverse culinary landscape, boasts a rich array of traditional sweets, including the beloved Chikki. This popular Indian snack is primarily made with jaggery, a natural sweetener, and roasted peanuts (Arachis hypogaea). The use of jaggery in sweets has gained popularity due to its recognized health benefit. Jaggery, derived from concentrated sugarcane juice, is a nutrient-rich sweetener. It contains protein, minerals, vitamins, and is an excellent source of iron and copper. Jaggery's unique sweet, winy flavor has made it a staple in Indian cuisine. While peanut Chikki is the most common variant, numerous other types are available. Some popular ingredients used in Chikki include puffed Bengal gram, sesame, puffed rice, beaten rice, and copra (desiccated coconut). Certain specialty Chikki are also made with cashew nuts, almonds, and pistachios, often combining multiple ingredients to create unique flavor Profiles. To take the beloved Chikki to the next level, a bold new variation was crafted, catering to the diverse tastes of India's population. The introduction of spicy flavors elevated the classic recipe, resulting in the creation of Spicy Peanut Chikki. This innovative treat combines the richness of roasted peanuts, the sweetness of powdered jaggery, and the nutty flavor of sesame seeds. To add an extra layer of depth, a custom blend of spices was added, featuring Chilli powder, Dried Ginger powder, Cumin powder and Rock Salt. The result is a mouthwatering Spicy Peanut Chikki that is sure to tantalize the taste buds of spice lovers across the Country. Spicy peanut chikki is a nutrient dense snack, containing vitamins, minerals and antioxidants; it contains peanuts, which is an excellent source of protein and healthy fat providing a natural energy boost. Spicy peanut Chikki can be a suitable option for consumption during fasting period because it does not contain any ingredients that are prohibited or restricted during fasting. It is easy to digest, convenient and supports immune function during fasting. Spicy peanut Chikki is flavorful and satisfying snack that can help make fasting more enjoyable and sustainable. This study explores the development, nutritional profile, and consumer acceptability of spicy peanut Chikki. The primary objective is to enhance the flavor profile without compromising the health benefits and traditional essence of the product. With a growing demand for snacks that combine health and taste, this research contributes to the development of innovative, nutritious snack options that resonate with both traditional and modern consumers. The study also investigates the role of spices in enhancing the organoleptic properties and shelf life of the product, making it a versatile addition to the snack food market. By bridging tradition with innovation, spicy peanut Chikki embodies the evolving trends in industry.

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Consumers are increasingly conscious about health and have begun to look at the nutritional benefits of food, disease prevention and health promoting compounds in many foods. According to market statistics, the global functional food and nutraceuticals market is increasing with a compound annual growth rate (CAGR) of 7.4%that is outpacing the traditional processed food market and is expected to reach USD 176.7 billion in 2013(Ahmad et al. 2011). Canada is emerging as a leading world supplier in this growing market and the country boasts more than 300 companies - from small start-ups to recognized for the incorporation of bioactive ingredients, such as soluble fibre from oats, barley and pulses, omega- 3 fatty acids from fish and flax oil, unsaturated fatty acids from canola oil, plant sterols and stanols from vegetable oils, and protein from soy bean. Industry is also putting efforts to incorporate functional ingredients into food products, such as probiotic bacterial cultures, prebiotics (e.g. fructo-oligosaccharides) from corn, bio-actives concentrated from berries and flax, and novel fibres from pulses etc (Ahmad et al. 2011). Peanut chikki, also called as peanut brittle in western countries is a ready to eat traditional sweet snack, which is popular throughout the country and consumed by all the sections of the population. The main ingredients used in chikki preparation include peanut, cane sugar or jaggery (gur) and liquid glucose (Vidyasagar et al. 1964). Puffed Bengal gram, sesame, puffed rice, coconut flakes (Manayand Shadaksharswamy 1995), sunflower kernels (Clandinin 1978) and soybean have also been used as ingredients either individually or in combination. Vidyasagar et al. (1964) have reported the preparation of groundnut candy and bar using sucrose, liquid glucose, roasted groundnuts, roasted split puffed Bengalgram, roasted white sesame (Sesamum indicum L.,) seeds and pineapple essence. Preparation of chikki based on sesame and peanuts, roasted Bengalgram dhal and jaggery has been reported by Prasadet al. (1995). Chahal and Sehgal (1996) have reported the development and nutritional evaluation of groundnut chikki and sesame-groundnut chikki. Gupta et al. (2007) studied the textural characteristics of sunflower-sesame kernel chikki.

The functional food industry in India is strong and is a growing force in the international health foods market. The health and wellness foods market is currently estimated to be in the vicinity of USD 1.6 billion and expected to reach USD 7.5–10 billion by the year 2015 (Palthur et al. 2009). In order to provide health benefits beyond basic nutrition, peanut chikki, a popular Indian traditional sweet snack, was taken to enrich with essential nutrients such as protein, Ca, Fe, vitamin A and folic acid so as to provide part of RDA to the targeted population. The RDA requirements for 10–15 years age group are: Ca (600 mg), Fe (28 mg) and protein 55 g. The primary objective of the present study was to develop a protein and mineral enriched peanut chikki and to evaluate its nutritional and other physico- chemical characteristics and acceptability.

The Spicy peanut Chikki is prepared by melting 50g of Jaggery powder, heating at 120°C and then adding 50 g of mixed spices (chilli powder, ginger powder, chat masala, rock salt) and grounded peanut. Pour the mixture in mold and let it set at room temperature (25°C) till it get hard. Spicy peanut Chikki is a delicious twist on the traditional Indian brittle, blending the sweetness of caramelized jaggery or sugar with the bold flavors of spices. This crunchy and flavorful snack is perfect for those who enjoy a balance of sweet, salty, and spicy tastes. It combines roasted peanuts, which provide a nutty and earthy base, with jaggery or sugar syrup, which binds the mixture into a firm yet crunchy texture. The addition of spices such as chili powder, black pepper, or even a hint of ginger elevates the Chikki to a new level, making it a unique treat. Spicy peanut Chikki can be stored in an airtight container for up to 2-3 weeks, making it a convenient snack to have on hand. Ensure it is kept in a cool, dry place to maintain its crispness.

II. MATERIAL AND METHODOLOGY

Table 1: Material Required for New Product Development

Material Required	Collection Of Raw Material
Jaggery powder	Super Market
Peanut	Super Market
Sesame seeds	Home
Butter	Super Market
Chilli powder	Home
Salt	Home
Cumin powder	Super Market
Ginger powder	Super Market

Chat Masala	Super Market
Curry Leaves	Home
Weighing Balance	Processing Lab
Pan	Processing Lab
Gas	Processing Lab

A. Peanut

Peanuts (Arachis hypogaea) are a type of legume that belongs to the family Fabaceae. They are native to South America and are widely cultivated in many parts of the world. Peanuts are a popular ingredient in many cuisines, particularly in Asian and African cooking. Peanuts are a nutrient-rich food that provides a range of essential vitamins, minerals, and antioxidants.

They are an excellent source of:

- Protein: Peanuts are a good source of protein, making them an excellent option for vegetarians and vegans.
- Healthy Fats: Peanuts are rich in healthy fats, including monounsaturated and polyunsaturated fats.
- Fiber: Peanuts are a good source of dietary fiber, which can help promote digestive health.
- Vitamins and Minerals: Peanuts are a good source of vitamins E and B3, as well as minerals like magnesium and potassium.

B. Jaggery Powder

Jaggery powder, often referred to as “Gur” in many South Asian languages, is a natural, traditional sweetener widely used in Asia, Africa, and Latin America. It is made from the concentrated juice of sugarcane or palm trees (such as date palms or toddy palms). Unlike refined sugar, jaggery is minimally processed, retaining its natural nutrients and offering a range of health benefits.

Jaggery powder contains more nutrients than refined sugar because it is not heavily processed.

- Carbohydrates: Primary source of energy.
- Minerals: Iron, calcium, magnesium, phosphorus, and potassium.
- Vitamins: Traces of B vitamins. • Antioxidants: Help combat free radicals in the body.

C. Sesame Seeds

Sesame seeds (Sesamum indicum) are a type of oil-rich seed that comes from the sesame plant, a flowering plant native to Africa and India. Sesame seeds have been a staple crop in many cultures for thousands of years, particularly in Asia and Middle Eastern cuisine.Sesame seeds are a nutrient-rich food that provides a range of essential vitamins, minerals, and antioxidants. They are an excellent source of:

- Protein: Sesame seeds are a good source of protein, making them an excellent option for vegetarians and vegans.
- Healthy Fats: Sesame seeds are rich in healthy fats, including monounsaturated and polyunsaturated fats.
- Fiber: Sesame seeds are a good source of dietary fiber, which can help promote digestive health.
- Vitamins and Minerals: Sesame seeds are a good source of vitamins E and B1, as well as minerals like calcium, magnesium, and potassium.
- Antioxidants: Sesame seeds contain a range of antioxidants, including sesamin and sesamolin.

D. Dried Ginger Powder

Ginger (Zingiber officinale) is a herbaceous perennial flowering plant belongs to the Zingiberaceae family .Traditionally it is known as oldest spice and used as folk Medicine.

This plant is used around the whole world in food as a spice in dried and fresh conditions for enhancing the flavor, make spicy and pungency taste to the meal (Jayashree and Visvanathan, 2011). It is a good source of minerals and vitamins (i.e. β- carotene, ascorbic cacid). This plant used as food masala (i.e. pickles, cookies, marmalade) in confectionery, seasoning and flavoring material in diet, bakery products and alcoholic and non-alcoholic beverage.

Dried ginger powder is used as alternative of fresh ginger . Dried ginger powder is made by two methods: Sun drying and Oven drying at low temperature. Dried ginger powder is substitute product of fresh ginger and stored for long time holding it's freshness. Dried ginger powder, also known as ginger powder or sonth, is a spice made from dried and ground ginger roots.

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Ginger (Zingiber officinale) is a flowering plant native to Southeast Asia, and its roots have been used for centuries in traditional medicine, cooking, and rituals.

E. Cumin Powder

The cumin (Cuminum cyminum Linn.) is an annual plant of the family Umbelliferae. Cumin powder is generally used as a food additive for imparting Flavour to different food preparations but it has also a variety medicinal properties . Cumin seed is converted to powder by the mechanical . process of grinding.

It also has a variety of medicinal properties . The oil of cumin is especially used as a carminative and astringent medicine . The seed yields a volatile oil (2 – 4%) which has an unpleasant bitter taste.

The proximate analysis of the cumin seeds reveals that they contain fixed oil, volatile oils, acids, essential oils, protein and other elements. Cumin contains some important components such as pinene, cymene, terpinene, cumin aldehyde, oleoresin, thymol and others that have shown their efficacy against various diseases. It is an important source of energy, strengthens immune system, gives protection against many diseases.

Cumin powder, also known as jeera powder, is a spice made from the seeds of the Cuminum cyminum plant, a member of the parsley family. Cumin is native to the Middle East and India, where it has been used for centuries in traditional medicine, cooking, and rituals.

F. Chilli Powder

Chilli has dominated and retained an important place amongst the spices worldwide. They are dried ripe fruits intuitively consumed as a spice, condiment, culinary, and medicinal purposes. The global consumption pattern is intriguing because of the inherent pungency, aroma, taste, spicy Flavour, and therapeutic properties. Predominantly, the colour and pungency decide the quality features and are actively responsible for organized marketing and trade of the dried chillies. India is one of the leading producers and exporters of chilli.

Chilli (Capsicum spp.) is an important commercial spice and vegetable crop for small and marginal farmers in Asia, Africa and South America. Among the 5 cultivated species of the genus Capsicum, C. annuum is the most widely cultivated in India for its pungent (chilli syn. hot pepper) and non- pungent (sweet pepper syn. capsicum, bell pepper) fruits. Red chilli powder is made by grinding dried red chillies.

G. Curry Leaves

Curry leaves (Murraya koenigii) are the leaves of a tropical tree native to India and Southeast Asia. They are a key ingredient in many Indian and Southeast Asian dishes, particularly in curries, stews, and chutneys. Curry leaves have been used for centuries in traditional Indian medicine and cooking. The leaves were mentioned in the ancient Indian medical text, the Charaka Samhita, which dates back to around 400 CE.

H. Rock Salt

Rock salt is also known as halite, is a naturally occurring mineral composed primarily of sodium chloride (NaCl). Rock salt is formed through the evaporation of ancient seas and salt lakes, resulting in concentration of sodium chloride and other minerals. Rock salt is used as a seasoning and preservative in various cuisines.

Rock salt is rich in minerals such as, iron, zinc, and potassium, it also has antibacterial properties, making it effective against certain types of bacteria. Rock salt, also known as Himalayan pink salt or halite, is a type of mineral salt that is mined from underground deposits.

It is composed primarily of sodium chloride (NaCl) and is known for its distinctive pink or white color Rock salt has been mined for thousands of years, with evidence of salt mining dating back to ancient civilizations in Egypt, Greece, and Rome. The Khewra Salt Mines in the Punjab region of Pakistan, which date back to the 13th century, are believed to be one of the oldest and largest salt mines in the world. Rock salt is typically mined through a process known as room and pillar mining, where large underground caverns are created to extract the salt. The salt is then crushed and ground into various sizes and textures for use in different application.

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III. METHODOLOGY

A. *Flow Chart for Preparation of Spicy Peanut Chikki*



B. *Method for preparing Spicy Peanut Chikki*

- Ingredient Selection: Source high-quality Peanut along with complimentary ingredient such as Jaggery Powder, Sesame seed and Spices.
- Roasting: Roast the Peanuts and Sesame seeds until it turns light brown.
- Preparing Jaggery syrup: Prepare Jaggery syrup by melting Jaggery power on heat.
- Adding Spices: After preparing Jaggery syrup, add spices such as, Ginger powder, Chilli powder, Cumin powder, Chat masala and Salt which adds spiciness to product.
- Mixing: Then add roasted ground peanut and sesame seeds in the syrup to form mixture.
- Molding: Pour the mixture in mold for even shape and thickness.
- Cooling: Allow it to cool in room temperature until it gets hard.
- Cutting: Cut the chikki in square shape.
- Storage and Packaging: Store the chikki in air tight container in room temperature.

IV. RESULT AND DISCUSSION

A. *Estimation of Moisture*

Moisture content was determined using the Oven drying method. Approximately 5 grams of the sample were weighed (W2) on pre-weighed petri plates (W1) and placed in an oven at 105º C for 3 hours. After drying, the samples were cooled in airtight desiccators to prevent moisture exchange with the environment. The drying process was considered complete when two consecutive weighing, taken an hour apart, showed variations of no more than 5 mg. Moisture content was calculated by subtracting the dried weight from the initial sample weight and expressed as a percentage. *[Adya Yadav, et al, 2016]*

$$\textbf{\% Moisture} = \frac{\textbf{Loss in weight}}{\textbf{Weight Of Sample}} \times \textbf{100}$$

B. *Estimation of Fat*

A 5 gm sample was weighed and packed in a thimble the prepared thimble was weighed to cross- check the weight of the sample. The thimble was then enclosed in a big cellulose thimble and then it was placed in a Soxhlet extraction tube, 250 ml, of petroleum ether, was added to the Soxhlet extraction tube containing the sample. The heating mantle was turned on and the temperature was set at 60°C. Petroleum ether gets evaporated and condensed and falls over the sample drop by drop and the speed of dropping should be 150 drops per minute. When clear color petroleum ether was seen in Soxhlet after 6-12 hours, the assembly was turned off. The round bottom flask containing the solvent was separated from the assembly to recover the solvent. The solvent was recollected by

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using the downward distillation unit for the next use and the round bottom flask holding the extracted fat sample was dried in a hot air oven at 105 "C until all the solvent was removed after drying the RBF was cooled in a desiccator and the weight was taken until the last three successive reading shows the difference less than 0.001 gm. A 5-gram sample underwent initial weighing and was then enclosed within a thimble. Subsequently, the thimble, now containing the sample, underwent inserted into a larger cellulose thimble. This combined setup was carefully positioned within a Soxhlet extraction tube. To facilitate the extraction process, 250 ml of petroleum ether was introduced into the Soxhlet extraction tube containing the sample. Upon activating the heating mantle and setting the temperature to 60°C, the petroleum ether underwent a cycle of evaporation, condensation, and dripping over the sample at a controlled rate of 150 drops per minute. Once the petroleum ether, now visibly clear, was observed in the Soxhlet after 6-12 hours, the entire assembly was deactivated. The round bottom flask, holding the solvent, was then separated from the apparatus to recover the solvent. The reclaimed solvent underwent further processing using a downward distillation unit for subsequent use. Meanwhile, the round bottom flask containing the extracted fat sample underwent drying process in a hot air oven set at 105°C until all the solvent was completely removed. Following drying, the round bottom flask was cooled in a desiccator, and its weight was measured until three successive readings showed a difference of less than 0.001 grams *[AOAC (1995)]*.

Percent crude fat was calculated as under:

$$\%\text{Crude fat} = \frac{\textit{Weight of fat}}{\textit{Weight of sample}} \times 100$$

C. Estimation of Protein

The protein content of the samples was determined utilizing the Kjeldahl method. Initially, 2 grams of the sample underwent digestion with 5 grams of a digestion mixture, comprising 10 parts potassium sulphate and 1 part copper sulphate, along with 20 ml of concentrated sulfuric acid. This digestion process continued in a Kjeldahl flask until the contents achieved a state of being carbon-free. The resulting digested sample was then adjusted to a final volume of 100 ml. A 10 ml aliquot of the digested sample was subjected to distillation with 20 ml of 30 percent sodium hydroxide. The liberated ammonia from this process was collected in a solution containing 20 ml of2 percent boric acid, enriched with 2-3 drops of a mixed indicator. cresol green, dissolved in 95 percent ethyl alcohol, with a ratio of 1:5, respectively. The entrapped ammonia was subsequently titrated against 0.1N hydrochloric acid. The nitrogen content in the sample was then calculated using the following expression:

$$\%\ \textit{Nitrogen} = \frac{14 \times \text{N of HCL} \times \text{Titre value (ml)} \times \text{Dilution factor} \times 100}{\textit{Weight of sample}(g) \times 1000}$$

D. Estimation of Total Ash

To determine the ash content, a 2-gram sample was placed in a silica crucible and ignited on a heater. Subsequently, the crucible was transferred to a muffle furnace and maintained at a temperature of 550º C ± 15º C until a clean ash was obtained. The weight of the resulting residue was then recorded, and the percentage of ash was calculated using the following formula:

$$\%\ \textit{Ash} = \frac{\text{Weight of residue}}{\textit{Weight of sample}} \text{x } 100$$

E. Estimation of Carbohydrate

The percent carbohydrates were calculated by subtracting the sum of moisture, protein, fat, ash and fiber from 100.

% CHO = 100 - (% Moisture + % Protein + % Fiber + % + Ash)

Proximate analysis of Spicy Peanut Chikki:

Table 2: Result of Proximate analysis:

Factors/Parameters (%)	Results
Moisture content	0.304%
Ash content value	0.2%
Crude Fat	10%
Crude Fiber	5.43%
Protein	12.65%
Energy	370 KCL

F. Observation

Sensory evaluation of spicy peanut chikki: in the campus of Ballarpur institute of technology for sensory evaluation of product, sensory panel is made in which 10 untrained panelist is present. The sensory panel is there for evaluation in which panellist observe colour, appearance, flavour, texture, taste and acceptability overall of product.

The mean sensory evaluation score for chikki in which jaggery is 100gm score: 6.25, 7.5,7,7.25 and 7 in sensory aspects such as taste, appearance, aroma, mouth feel, colour and overall appearance.

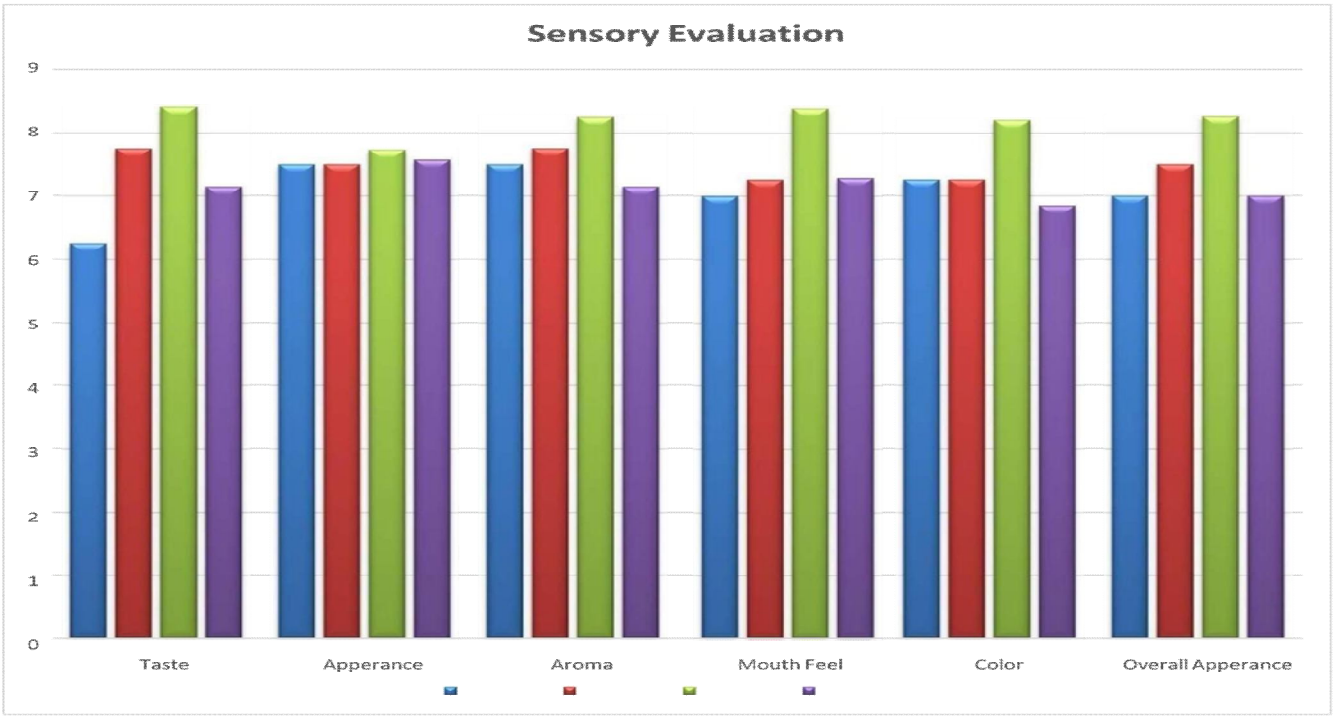
The mean score of sensory evaluation of Spicy Chikki prepared using 60g Jaggery scored: 7.75, 7.5, 7.75, 7.25, 7.25 and 7.5 in sensory aspects such as taste, appearance, aroma, mouth feel, color, overall appearance.

The mean score of sensory evaluation of Spicy Chikki of 50g is presented. It got a score of 8.41, 7.73, 8.25, 8.39, 8.20 and 8.26 for taste, appearance, aroma, mouth feel, color, overall acceptance respectively. Overall it was scored within the range we preferred by the Judge's Panel.

The mean score of sensory evaluation of 70g Is Spicy Chikki presented. It got a mean score of 7.14, 7.57, 7.14, 7.28, 6.85 and 7 for taste, appearance, aroma, mouth feel, color, overall acceptance respectively.

Thus from all the results of sensory evaluation of Spicy Peanut Chikki it can be concluded that panelist has 'liked very much' (Score-8) of Sample 7 (Jaggery 50 gm) based on their attributes of color, taste, texture, mouthfeel and odor.

V. SENSORY GRAPH



VI. FINAL PRODUCT



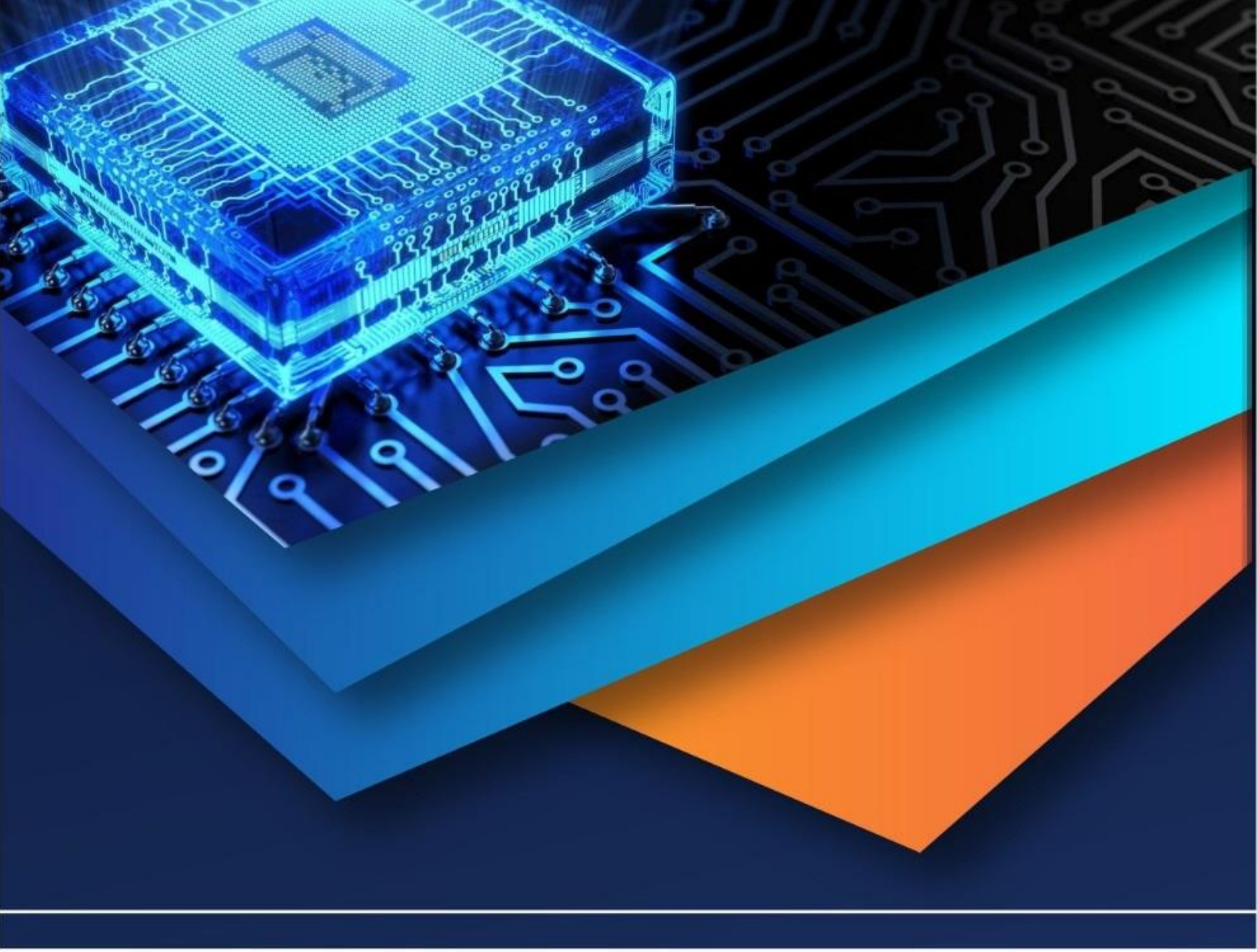
Fig. Final product of Spicy Peanut Chikki.

VII. CONCLUSION

This research demonstrates the potential for innovation in traditional confections by incorporating novel ingredients and flavor profiles. The development of Spicy Peanut Chikki offers a unique fusion of traditional Indian cuisine with modern flavors, which can appeal to a wider range of consumers. The results of this study provide a foundation for the commercial production of Spicy Peanut Chikki, which can help to revitalize the traditional Indian confectionery industry. The research on the development of spicy peanut Chikki highlights its potential as an innovative and nutritionally enriched snack. By integrating spices into the traditional peanut Chikki recipe, the study demonstrates a successful fusion of flavors that caters to modern consumer preferences for taste and health benefits. The product showcases balance of macronutrients, a boost in antioxidant properties from spices, and adherence to sensory acceptance criteria.

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